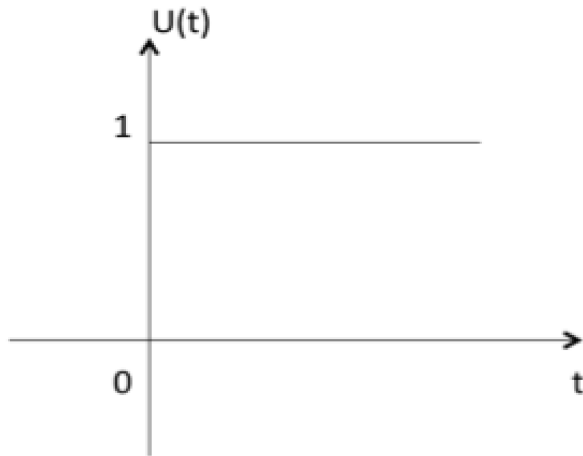


Here are a few basic signals:

Unit Step Function

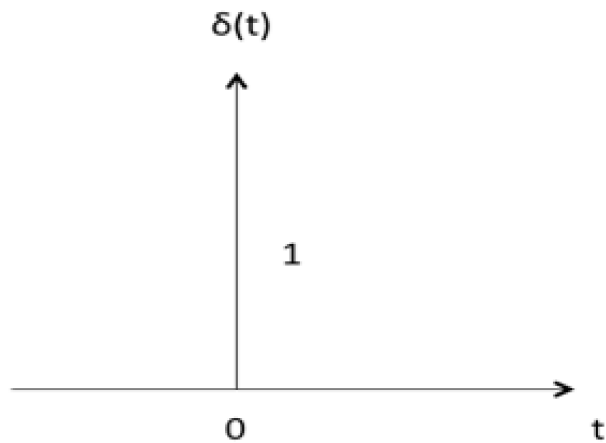
Unit step function is denoted by $u(t)$. It is defined as $u(t) = \begin{cases} 1 & t \geq 0 \\ 0 & t < 0 \end{cases}$



- It is used as best test signal.
- Area under unit step function is unity.

Unit Impulse Function

Impulse function is denoted by $\delta(t)$. and it is defined as $\delta(t) = \begin{cases} 1 & t = 0 \\ 0 & t \neq 0 \end{cases}$

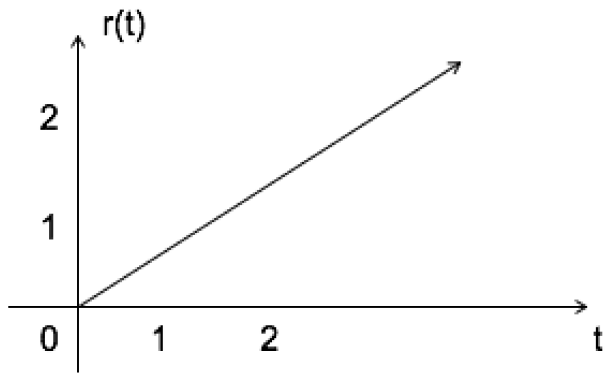


$$\int_{-\infty}^{\infty} \delta(t) dt = u(t)$$

$$\delta(t) = \frac{du(t)}{dt}$$

Ramp Signal

Ramp signal is denoted by rt , and it is defined as $rt = \begin{cases} t & t \geq 0 \\ 0 & t < 0 \end{cases}$



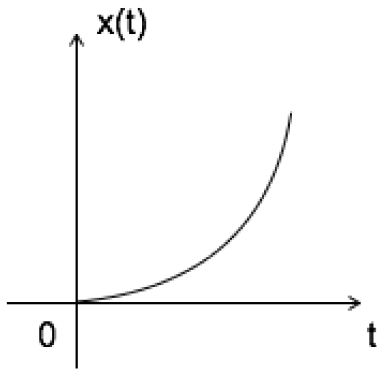
$$\int u(t) = \int 1 = t = r(t)$$

$$u(t) = \frac{dr(t)}{dt}$$

Area under unit ramp is unity.

Parabolic Signal

Parabolic signal can be defined as $x(t) = \begin{cases} t^2/2 & t \geq 0 \\ 0 & t < 0 \end{cases}$



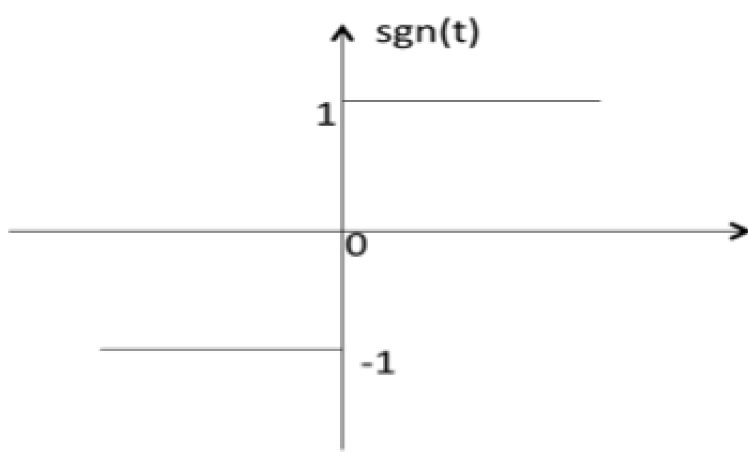
$$\iint u(t) dt = \int r(t) dt = \int t dt = \frac{t^2}{2} = \text{parabolic signal}$$

$$\Rightarrow u(t) = \frac{d^2 x(t)}{dt^2}$$

$$\Rightarrow r(t) = \frac{dx(t)}{dt}$$

Signum Function

Signum function is denoted as $\text{sgn}(t)$. It is defined as $\text{sgn}(t) = \begin{cases} 1 & t > 0 \\ 0 & t = 0 \\ -1 & t < 0 \end{cases}$



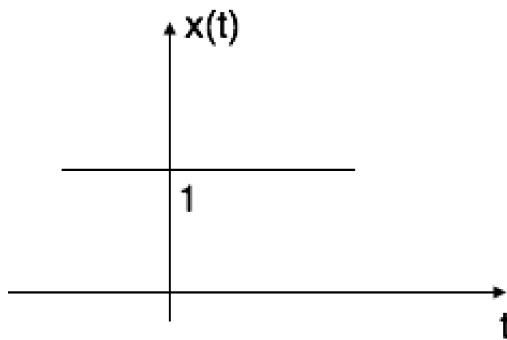
$$\text{sgn}t = 2ut - 1$$

Exponential Signal

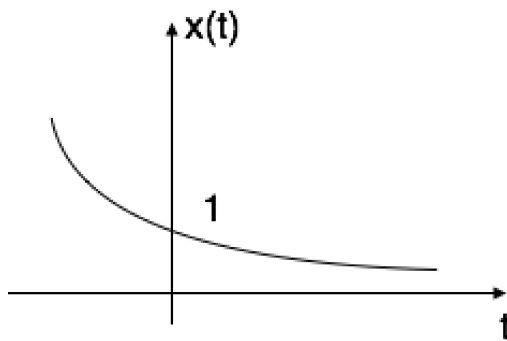
Exponential signal is in the form of $x(t) = e^{\alpha t}$.

The shape of exponential can be defined by α .

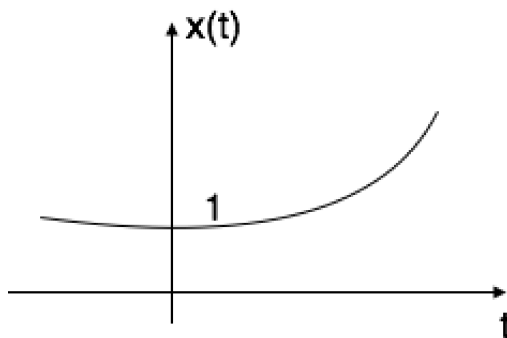
Case i: if $\alpha = 0 \rightarrow x(t) = e^0 = 1$



Case ii: if $\alpha < 0$ i.e. -ve then $x(t) = e^{-\alpha t}$. The shape is called decaying exponential.



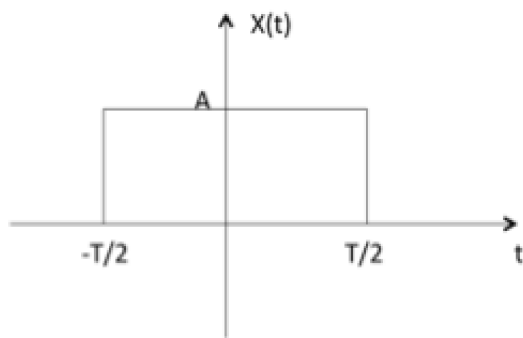
Case iii: if $\alpha > 0$ i.e. +ve then $x(t) = e^{\alpha t}$. The shape is called raising exponential.



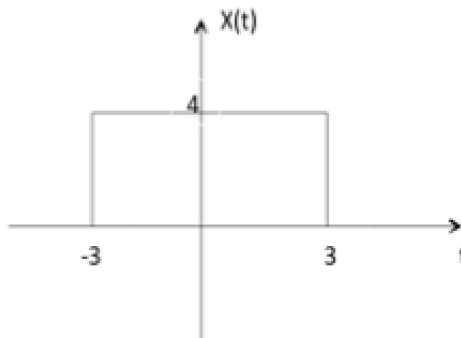
Rectangular Signal

Let it be denoted as $x(t)$ and it is defined as

$$x(t) = A \operatorname{rect} \left[\frac{t}{T} \right]$$



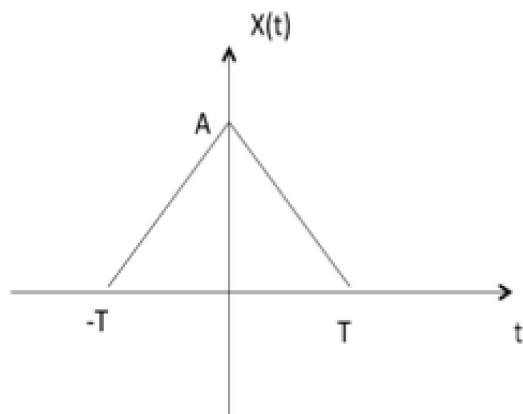
$$\text{ex: } 4 \operatorname{rect} \left[\frac{t}{6} \right]$$



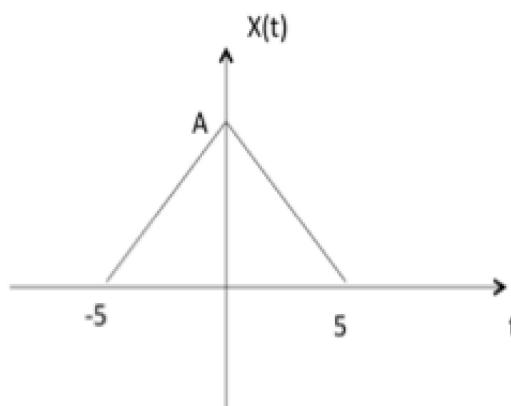
Triangular Signal

Let it be denoted as $x(t)$

$$x(t) = A \left[1 - \frac{|t|}{T} \right]$$

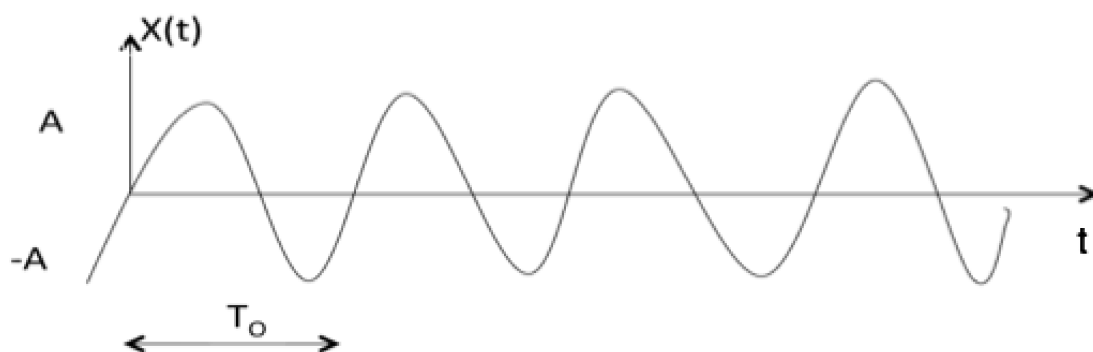


$$\text{ex: } x(t) = A \left[1 - \frac{|t|}{5} \right]$$



Sinusoidal Signal

Sinusoidal signal is in the form of $x(t) = A \cos(\omega_0 t \pm \phi)$ or $A \sin(\omega_0 t \pm \phi)$



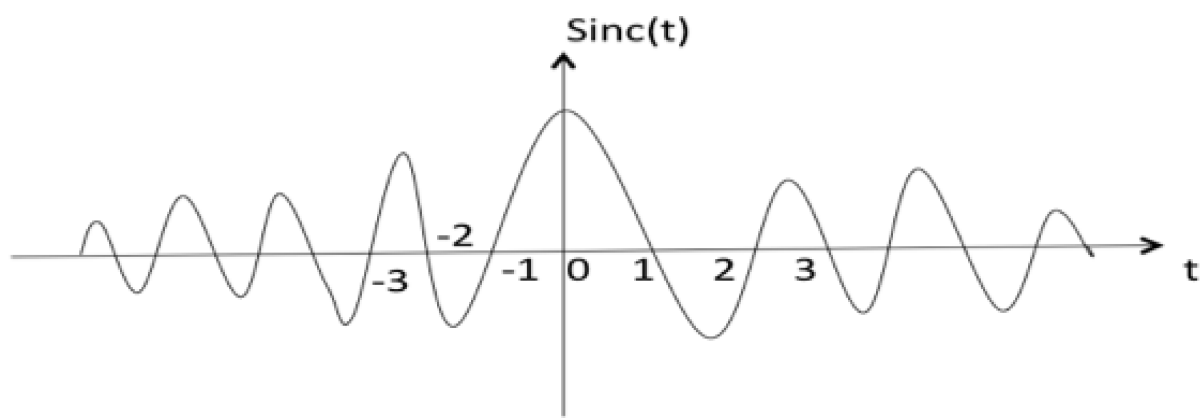
$$\text{Where } T_0 = \frac{2\pi}{\omega_0}$$

Sinc Function

It is denoted as $\operatorname{sinc}(t)$ and it is defined as

$$\operatorname{sinc}(t) = \frac{\sin \pi t}{\pi t}$$

$$= 0 \text{ for } t = \pm 1, \pm 2, \pm 3, \dots$$



Sampling Function

It is denoted as $\text{sa}t$ and it is defined as

$$\text{sa}(t) = \frac{\sin t}{t}$$

$$= 0 \text{ for } t = \pm\pi, \pm2\pi, \pm3\pi \dots$$

